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ABSTRACT

The Information Services Plan (ISP) developed at Howard Community College (HCC), in Columbia, Maryland, is designed to ensure that the necessary data, equipment, and communications technologies will be available to enable the college to meet its strategic goals. The plan provides for analyses of the current information services operating environment, user-identified problems and future directions, and alternative methods and costs for solving current problems and meeting future demands. Specific ISP priorities and recommendations related to HCC's information technology needs for the 1994-97 period include the following: (1) upgrading and expanding all student computer laboratories to include 486 class computers, interactive video equipment, and updated software; (2) providing support for multimedia development and delivery of instruction; (3) upgrading or replacing the current mainframe computer to support expanding demand; (4) installing a college-wide fiber optic network with attached local area networks for various work groups; (5) upgrading staff equipment to ensure that they are able to take advantage of new technology and increase productivity; (6) installing additional software to support admissions, tracking, and on-line purchasing; (7) providing access to external databases through the Internet; (8) improving access to and quality of reprographics and document storage and retrieval; and (9) providing personnel and training to support the new technology. Data tables containing projected expenses are included. Strategic goals and priorities for HCC as of October 1993 are appended. (MAB)

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HOWARD
COMMUNITY COLLEGE

DEVELOPING A COMPREHENSIVE STRATEGIC PLAN FOR CAMPUS COMPUTING

◆A User-Friendly Approach◆

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Executive Summary

Information Services Plan

1994 - 1997

The Howard Community College Information Services Plan outlines a direction that make technology available to assist the college in accomplishing its strategic priorities over the next four years. Since technology is changing so rapidly and funding is uncertain, it is difficult to plan four years in advance for specific purchases; therefore, the plan presents an analysis of the best alternatives currently available. Each major purchase should be reevaluated to ensure that the best and most cost-effective solutions available are selected.

Technology will dramatically change the way education is delivered in the future, but the costs associated with the change will be enormous. Colleges which are successful in educating the student of the future will have no choice but to provide for these new methods of educational delivery. Technology will also be necessary to stem the rapid rise in non-academic operational and personnel costs. Because of the expected decline in revenues available to higher education in the future, grant funding may be necessary to finance the expanded use of technology.

Accomplishments in FY93

Considering the difficult budget situation, the college, through careful cost control measures, has managed to preserve funds to substantially accomplish all information services goals planned for FY93. In addition, a number of activities planned for future years were moved into FY93 as needs and available funds changed. The table on the following page summarizes the planned and actual activities for FY93:

PLANNED ACTIVITY	PLANNED EXPENDITURES	ACTUAL EXPENDITURE AND COMMENTS
Upgrade and expand student labs	\$340,000	\$301,000
Multimedia equipment	\$ 20,000	\$ 18,000
Optical Disk for HP3000	\$ 44,000	Cancelled — Determined technology not appropriate for this application
Student Tracking System	\$ 15,000	Completed in-house at no cost
Touchtone Registration System	\$ 60,000	\$ 60,000
Inlex Modules	\$ 5,000	\$ 5,000
Software Updates	\$ 10,000	\$ 21,000
Ports for HP3000	\$ 10,000	Delayed until LAN design completed
Memory for HP3000	\$ 18,000	Delayed — no evidence of system degradation
Laptops for Staff	\$ 4,000	\$ -0-
Room Scheduler	\$ 35,000	\$ 42,000
Staff Equipment	\$ 98,000	\$112,500
Training	\$ 18,000	\$ 8,000
Computer Testing	\$ 27,000	\$ 36,000

The table below summarizes the costs of the technology that is recommended for the college over the next four years and categorizes these costs by the strategic priorities that are most directly affected by the expenditures.

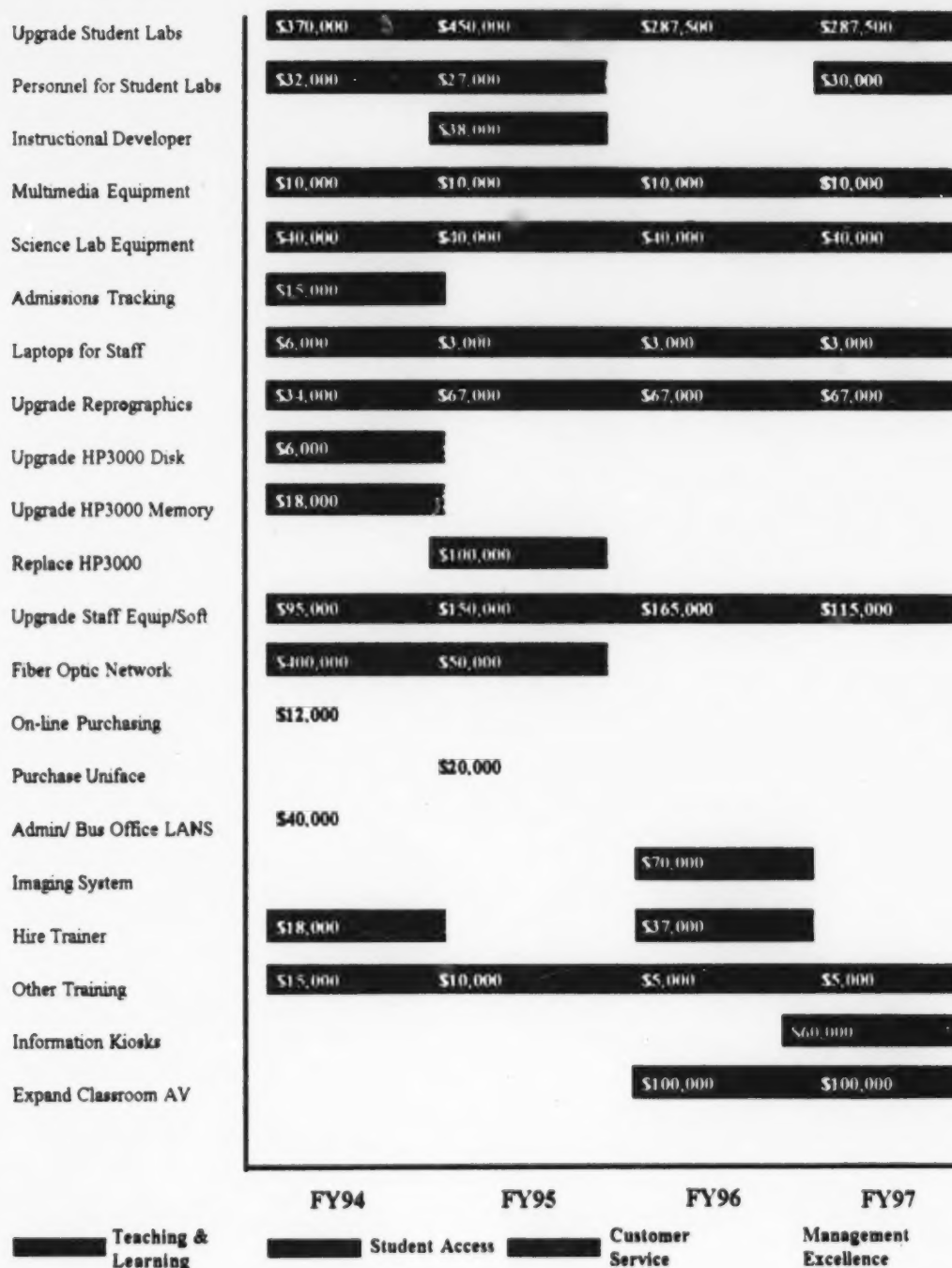
YEAR	TOTAL	Teaching and Learning	Student Access	Customer Service	Management Excellence
FY94	\$1,114,000	\$ 452,000	\$ 15,000	\$ 592,000	\$ 52,000
FY95	\$ 985,000	\$ 565,000		\$ 380,000	\$ 20,000
FY96	\$ 784,500	\$ 437,500		\$ 347,000	
FY97	\$ 717,500	\$ 467,500	\$ 60,000	\$ 190,000	
TOTAL	\$3,578,000	\$1,922,000	\$ 75,000	\$1,509,000	\$ 72,000

In summary, the major components of the plan provide for:

- ◆ Upgrading and expanding all student computer laboratories, as well as mathematics, English, foreign language, science, and learning assistance laboratories to include 486 computers, interactive video equipment, and updated software.
- ◆ Providing support for multimedia development and delivery of instruction.
- ◆ Upgrading or replacing the HP3000 to support current and future applications.
- ◆ Installing a college-wide fiber optic network with attached local area networks for various work groups.
- ◆ Upgrading equipment for staff to 386 or 486 (or higher) computers, and software, including new versions of Windows, to ensure that they are able take advantage of new technology to improve productivity.
- ◆ Installing additional software to support admissions tracking and on-line purchasing and migrating the existing CEI system to a distributed processing environment using a relational database manager and graphical user interface.
- ◆ Providing access to external databases through Internet.
- ◆ Improving access to and quality of reprographics and document storage and retrieval.
- ◆ Providing personnel and training to support the new technology.
- ◆ Providing student and community information kiosks for accessing student records and information.

The chart on the following page summarizes the information technology needs of the college for the next four years, and the color code indicates the strategic priority addressed by each proposed purchase. Details of each recommendation are outlined later in this document.

PLANNED PURCHASES FOR INFORMATION SYSTEMS FY94 - FY97



Information Services Plan 1994 - 1997

The Howard Community College Information Services Plan provides an analysis of the current information services operating environment, an analysis of user-identified problems and future directions, discussions of alternative methods and costs for solving current problems and meeting future demands, and recommendations and priorities for planning and budgeting for the information technology needs of the college in the future.

The purpose of the Information Services Plan is to outline a strategic direction that will ensure that the data, equipment, and communications technologies will be available to move the college towards the accomplishment of its strategic priorities and goals. The Information Services Division has defined its specific relationship to the strategic priorities as follows:

Strategic Priority Goal of Information Services

Student Learning and Teaching Excellence

To provide equipment, software, and services that will assist faculty in improving student learning and satisfaction with instruction and to provide computer support for student laboratories, the library, and the learning assistance center that will maximize student and faculty satisfaction with the learning environment.

Student Access

To provide support for registration, testing and admissions processes and to provide data that will result in planning for improved student access and retention.

Customer Service

To provide computer support that will allow students, faculty, staff, and the community to use college resources in an effective, efficient, and pleasant manner.

Management Excellence

To provide data for management decision making that maximizes the probability of achieving strategic priorities.

Current Environment

Mainframe Hardware

The Hewlett Packard HP3000 Series 955 computer, purchased in 1990, with 96 megabytes of internal memory and 3.5 gigabytes of disk storage supports both administrative and academic computing. A Hewlett Packard HP2680, 45 page per minute, laser printer, purchased in 1985 and rebuilt in 1990, provides 180 dpi laser printing for both local and remote users. The system also supports seven remote spooled printers.

Modems provide off-site dial-up access for faculty, staff, and students. Data terminal interfaces to the telephone system provide on-site access for faculty and staff. Tape drives provide for system backup and recovery.

Mainframe Operating System and Software

The HP3000 currently runs HP's MPE XL operating system software. However, the HP3000 now supports the POSIX standard. This allows the HP3000 to not only support the MPE-XL operating system, but also to concurrently support UNIX.

CEI Plus, an the administrative and student information software system, was purchased in 1990 and includes admissions, application, registration, financial aid, general ledger, accounts payable, accounts receivable, inventory, on-line budgeting and purchasing and personnel/payroll modules. Other related software includes interfaces to touchtone registration and room scheduling software, which are in the process of implementation. An applicant tracking module for tracking student applications and purchasing software designed to run in a distributed processing environment is available but has not been purchased. The CEI Plus system includes Data Express, a report writing and file manipulation language that provides for easy generation of reports by designated users. The college has a licensing agreement for all CEI modules and does not own the source code. A version of the CEI Plus software featuring a graphical user interface and using All Base, a relational database manager which the college already owns, is expected to be available in the next year at no cost to the college except for the purchase of a run-time version of Uniface, a database development and query language.

The INLEX on-line library administration system software was purchased in 1991 and provides on-line reference and circulation systems. This system is interfaced with the CEI Plus software to provide the library with updated information on students, faculty and staff. Currently implemented modules include Administration, Circulation, Acquisitions, Reporter, Back-up Circulation, Reference, and Bibliography. The company is in Chapter 11 bankruptcy and future enhancement of the system is uncertain.

HPDesk software provides an electronic mail and calendaring system to 95% of college employees. Other software includes SPSS-X, a batch statistical manipulation language for research and student use; COCO, a financial aid awards management system; and a COBOL 85 compiler for both administrative programming and student use.

Mainframe software which supports student labs includes FORTRAN 77, BASIC, and COBOL 85 compilers and the SPSS-X statistical package.

Administrative Microcomputers and Software

Ninety percent of all faculty and staff members have 386/486 microcomputers. A few still have XT's or 286 clones. They use DOS 5.0 or 6.0, Windows 3.1, Word Perfect 5.2 for Windows as word processing software and HPDesk for electronic mail and calendaring. About fifty percent of these users also use spreadsheet software (Lotus 1-2-3 or Quattro Pro for Windows) and database software (Dbase III or Paradox for Windows). A few users also use graphics/desktop publishing/presentation software (Ventura, Pagemaker, Harvard Graphics, Powerpoint etc). Because of favorable pricing and the need to limit the number of software packages supported, Word Perfect for Windows, Quattro Pro for Windows, and Paradox for Windows will be the only packages purchased for word processing, spreadsheet, and database management. Powerpoint will be supported as the presentation software package. MS92 serves as the terminal emulation software for all users and includes PerfectDesk, a software package that allows text editing in HPDesk to be done in Word Perfect. All users with 386/486 computers also have More Fonts (a font package) and Detect Plus (A virus scanning package.)

Each administrative and instructional office has at least one HP Laserjet III or Laserjet IV printer. Many users are remotely linked to the Laserjet in their office via the ROLM telephone system, a Newbridge data controller, and Easystreet networking software. Many administrative and faculty users also have locally attached low-end dot matrix printers or HP Deskjet 500 Inkjet printers.

FundMaster software is used in the development office to track donors and to perform accounting functions.

The personnel office uses server-based software, Abra Ca Dabra, which interfaces with CEI to maintain a personnel and benefits database and reporting system.

Data Communications

All faculty and staff microcomputers (approximately 250) are configured with terminal emulation software. The software allows users to connect to the HP3000 via the ROLM phone system. Each microcomputer is connected through its serial port to a Rolmphone equipped with a Data Communications Module (DCM). The DCM's are connected to the ROLM system, and software on the ROLM system (transparent to the users) connects a user's microcomputer to a port on the HP3000. The ROLM system also allows HP terminals to connect to the HP3000 in a similar manner. The college has in use approximately 8 HP 2392 terminals.

The ROLM and HP3000 systems allow for low speed, asynchronous data transmission at up to 19.2 kilobits per second. Inbound and outbound modems are also available for students (inbound only), faculty and staff. The ROLM system switches users to one of the seventy ports available on the HP. If no HP ports are available, the ROLM switch will put users in a queue. The ratio of users to ports is about 3 1/2 to 1. For all but a few weeks of the year (registration), this ratio has been sufficient. The Easystreet software allows users to send or receive files from other microcomputers. Easystreet is not a client-server environment like Novell's Netware but it is a low cost solution to printer sharing and file exchange.

Records Storage

Financial and student records are currently archived by microfilming which is provided by a service bureau.

Student Laboratory Equipment and Software

Approximately 100 MS-DOS PC's are available in general purpose microcomputer labs for student use. The equipment and software are as follows:

Laboratory	Hardware	Quantity
Open Lab L149	486 class clones	30
Class Lab L148	386 class clones	25
Class Lab L147	386 class clones	20
Class Lab L146	286 class clones	20

Twenty of the computers in L147 are networked using an Ethernet network running Novell Netware 3.11. The network has a dedicated 486 class clone file server.

Software for the above computers includes WordPerfect 5.1, WordPerfect 5.2 for Windows, Quattro for Windows, Quattro Pro 3.0, DBaseIII Plus, MS-DOS 5.0 or 6.0, Turbo C 2.0, Turbo Assembler, BASIC, Paradox 3.5, and Paradox for Windows. In addition, the Open Lab L149 has math software, accounting software, nutrition software, statistical software, and terminal emulation software. Additional computers are available in special purpose labs as follows:

Laboratory	Hardware	Quantity	Software
Reading Lab	286 clones	24	Reading
Writing Lab	286/386 clones	26/21	WP 5.1, lab specific
Math Lab	486 clones	4	Mathematics
Nursing Lab	XT, 386 clones, 486 clone	4/1/5	Nursing
Biology Lab	Apples	8	Biology
Chemistry Lab	Apples	8	Chemistry
Physics Lab	Apples	8	Physics
CAD Lab	486 clones	22	AUTOCAD 12
Art/Music Lab	486 clones	16	Music, Corel Draw
Secretarial Lab	XT/486 clones	23/18	WP 5.1, WP for Windows

Each lab has projection equipment to project computer output. The Art/ Music Lab has MIDI interfaces and speakers installed in each unit, with each unit is connected to an electronic keyboard. The mathematics lab has four video disk players for running MODUMATH interactive video software, and the nursing lab has ten for running a variety of nursing videodisks.

Telecommunications

A ROLM telephone system was installed in 1984 and upgraded in 1990 to a ROLM 9751 model 10. A ROLM PhoneMail System, release 4.2, was also installed in 1990. The phone system supports over 300 users, 90% of whom use a digital Rolmphone. The ROLM system also supports 19 incoming DID trunks and 20 outgoing CO trunks. The Phonemail system, supporting over 300 users, is an 8 channel system with disk space for about 22 hours of message storage. Although some of the wiring in the system is old, all new wiring is being done with cabling using two 4 pair unshielded twisted pair plenum cables to each jack. The cable is rated for high speed data.

Reprographics

High speed copiers in the printshop are a Kodak 250AFB and a Xerox 1090. The college purchased the Kodak in 1984, and the Xerox is leased with the lease expiring in December of 1993. Both copiers have automatic document feeders and finishing units for sorting, collating, and stapling. Both copiers are optical and make images from a hard copy original via a photographic process. The volume for FY93 averaged 600,000 copies per month which reflects an increase averaging 10% per year over the last five years.

In addition to the high speed copiers, sixteen small copiers are located in various offices. These copiers average three years of age and the volume is about 750,000 copies per year which reflects a decrease from previous years because of expanded printshop services

Organization and Operations

The Information Services department currently is staffed as follows:

- 1 Executive Director of Information Services
- 1 Director of Computer Services
- 1 Director of Telecommunications and Office Automation
- Computer Support Specialist
- Part-time Secretary
- 3 Programmer/Analysts
- 3 Computer Operators
- 3 Microcomputer Repair Technicians
- 1 Lead Press Operator
- 1 Duplicating Machine Operator

Beginning in October of 1993, the department will partially transition to a facilities management contract for some of the operation. The contract has been awarded to MagNet Services in Seattle, Washington. All positions with the exception of the Director of Telecommunications, Computer Support Specialist, Secretary, 3 microcomputer technicians, and the 2 press operators will be removed from the college payroll no later than June 30, 1995.

Analysis Of Current Problems And Proposed New Applications

User groups in each of the four functional areas identified deficiencies in the current system and projected future applications requiring system support. The recommendations were then reviewed and approved by the Administrative MIS Committee and the Academic Council and then prioritized by Cabinet based on the strategic priorities and goals of the College (See Appendix A for Strategic Goals and Priorities). A Phase I designation indicates that the item is of highest priority. In addition, the current throughput and peak load conditions of the HP3000 were analyzed, and detailed projections for computer needs for academic programs were reviewed.

Problems and Future Directions Identified by User Groups

ADMINISTRATIVE ISSUES		
PHASE	PRIORITY/GOAL	SUGGESTED IMPROVEMENT
1	III B&C	On-line room scheduling capability
1	II D	Touchtone telephone registration capability
1	VB	Staff capability to generate reports from various internal and external databases
1	III B	Additional training for all staff
1	III B	Elimination of HPDesk downtime during peak activity
1	III B	Desktop access to high speed laser printing
1	VB	Network access to shared files by workgroups
2	III B	On-line access to national databases using INTERNET
2	II D	Applicant Tracking System
2	VB	On-line purchasing system
3	III B	Capability for facsimile transmission and receipt at the desktop
3	II D	Electronic transmission and receipt of transcripts
3	III B	Optical disk/scanning system to replace microfiche
3	III B	Computers for home use for all staff
3	III D	Improved electronic mail system
3	III B	Centralized server-based system for installing and updating software

INSTRUCTIONAL ISSUES		
PHASE	PRIORITY/GOAL	SUGGESTED IMPROVEMENT
1	1 A&B	Interactive video software for instructional laboratories
1	1 A&B	Improved student monitoring capability in CEI requiring software modifications
1	1 A&B&C	Additional mobile computer projection units including capability to project interactive video
1	1 D	Multimedia capability in classrooms and equipment and personnel to support faculty development of multimedia materials
1	I A&B, II B	Expansion of reading, writing, and mathematics laboratories to include computers and interactive video units at each station
2	1 A&B	Computers and authoring system with instrument integration for science
2	1 A&B	Electronic library access to national databases with download capability
2	1 A&B	Additional expansion of open computer laboratories and addition of interactive video units
3	III C	Provision of student and public access to information through computerized information kiosks
3	1 A&B	Computer/Interactive Video Foreign Language Laboratory
3	IV B	Access to computers for part-time faculty

Analysis of Throughput and Peak Load Conditions of HP3000

Currently, users experience little system degradation except during the six weeks of registration each year. However, during peak periods users are frequently denied access to the HP3000, with the queue frequently reaching eight to ten users. This is due to a lack of an adequate number of computer ports and data terminal interfaces, but additional users would also affect system performance.

To provide an understanding of how the system is currently being used and what processing capacity remains available, system utilization data was collected using HP SCOPE software and was interpreted with the assistance of an HP Performance Specialist.

The test showed that during registration periods, the CPU peaks at 100% utilization. CPU utilization exceeding 80% is typically an indication of a potential bottleneck, but this activity included high batch activity and should not be significantly impacting interactive user performance at the present time. The CPU utilization showed peak averages of around 70%. Any significant expansion in the number of users or the number of mainframe-based applications would probably require upgrading the CPU.

Memory management CPU utilization was below the 5% mark where potential pressure is indicated. The memory management disk IO rate was also below the recommended maximum of five per second, but peaked during registration periods at 6.5 per second, indicating a shortage of main memory. Physical Disk IO utilization was well below maximum disk capacity.

Disk space is currently 80% utilized, with the recommended maximum being 80%.

Analysis of Projected Future Computing Needs for Academic Programs

A detailed course-by-course analysis of projected computing needs to accommodate a twenty five percent increase in the number of students served in the next five years and to accommodate increased in-class computer use and increased outside assignments requiring computers was prepared by the academic staff. This analysis included all projected student use of general purpose computer laboratories.

Based on this analysis, four to six new computer classrooms and an additional 100 stations in the open computer laboratory will be needed within two to four years to accommodate projected use. This increased availability of stations in open laboratories will also provide access to computing facilities for part-time faculty. A minimum of one classroom and a quarter of the stations in the open laboratory will also need to be equipped with interactive video equipment.

In addition, an estimated 150 computers and 75 interactive video units will need to be added in reading, writing, mathematics, the learning center, and the foreign language laboratories.

Science laboratories will need an estimated 100 computers and 25 interactive video units.

Summary of Current Problems and New Applications

Based on the analysis of the current system capacity of the HP3000, the projections for computer requirements for academic computing, and input from all user groups, current problems and future improvements that must be planned for are categorized as follows:

1. Instructional computing laboratories, developmental laboratories, computing classrooms, science laboratories, foreign language laboratories and other learning resource facilities will need to be expanded and upgraded to meet future requirements for basic computing facilities and for innovative instructional technologies such as interactive video, multimedia classrooms, teleconferencing, remote access to computing facilities, and remote access to libraries and databases. These improvements will be necessary to maximize student learning and teaching excellence. Facilities, support, equipment and training to allow faculty to develop multimedia materials will be needed.
2. The HP3000 will need to be upgraded to support an increase in the number of users and expected network overhead that will be necessary in the future to provide better customer service to students and staff and to improve productivity and decision making.
3. Records storage must be improved to provide for less expensive storage of an expanding volume of records and to provide more efficient access to archived data.
4. An college-wide local area network will be necessary to provide higher speed and more reliable and secure access to shared data and shared resources.
5. Printing capabilities will need to be enhanced to provide for increased volume and increased demand for high quality printing functions.
6. Staff training and support will remain a critical issue as changes in technology accelerate and become more complex.
7. New CEI modules running in a distributed processing environment and using a graphical user interface and relational database manager will need to be implemented.
8. Methods of providing on-line access for students and visitors to student records and other information about college events will need to be developed.
9. Movement to a LAN-based electronic mail system with enhanced features should be evaluated.

Alternatives For Future Investments In Information Technology

Reprographics

Copier volume has increased rapidly with the growth in students, staff, and programs. To accommodate continued growth, the college will need to plan for the use of new technology to manage the reprographic process.

The two high speed copiers currently in the printshop will be reaching monthly volumes averaging over 300,000 copies per machine in the next two years. With this volume, it is expected that the downtime will increase significantly. Increased volume, coupled with the age of the two copiers, will necessitate new equipment with new features and with the capacity to handle higher volume. As the college staff serves more and more students and expands the development of instructional materials, desktop access to high speed laser printing with postscript capability will be essential to maximize staff efficiency and effectiveness. Obviously, the implementation of this feature depends on the installation of a campus-wide network.

There are two primary vendors in the market today, Kodak and Xerox. Given volume projections, the college has these options: 1) replacing the two existing machines with one higher speed optical copier of the same class as the existing machines or 2) replacing the two existing machines with a top-of-the-line machine from one of the vendors. In general, the costs of leasing plus maintenance is roughly equal to the costs of purchase plus maintenance over a five year period. Although the purchase option would be less expensive if the life of the equipment extended significantly beyond five years and no major repairs were necessary, a lease gives the option of upgrading to new technology when it becomes available.

At projected pricing levels, lease and maintenance costs for the first choice, including a binding unit, would cost around \$103,200 per year. This choice stays with current optical technology and doesn't bring any new capabilities to the college.

The second choice, a top of the line machine, would yield a higher volume limit, higher speeds, and new technology and features. Xerox's top of the line product is called Docutech. It is a very large, high-speed copier/duplicator that uses scanning and digital processing instead of a photographic process. The machine scans hard copy originals and stores them on disk. The operator can then manipulate the images as well as schedule print jobs. Xerox provides a connectivity option for the Docutech that will allow it to be connected to a local area network. This feature allows users on a LAN to send documents directly to the Docutech. Expected maintenance and lease fees for the Docutech with the connectivity option and binding unit is \$140,400 including lease and maintenance costs.

Kodak's comparable solution is the Lionheart, a digital copier/duplicator. Documents are received from a print server, or they originate as files on diskette or a local area network. Lease and maintenance costs for the Kodak machine with binding unit are \$106,560. One advantage of the Kodak solution is that it uses a standard postscript protocol rather than the proprietary protocol used by Xerox which translates postscript files. Both the Kodak and Xerox technologies are capable of handling peripherals that fold and bind in one operation. The Kodak machine lacks the capability to print 11 x 17 size materials.

The college has enough capacity to meet demand through fiscal year 1994, although it is expected that downtime will increase as volume increases resulting in a degradation of service. The Xerox 1090 rental expires in December of 1993 so new equipment arrangements will have to be made at that time.

It is recommended that the college commit to the new technology after completing a cost/benefit analysis of the Kodak and Xerox options. This will represent an increase over current costs of between \$50,000 and \$70,000 per year.

Short-term administrative Hardware and Software Investments

The HP3000 system test indicated that there are three problems which will need to be addressed within a one to two year period:

- (1) Expansion of disk storage capacity
- (2) Expansion of computer ports and data terminal interfaces
- (3) Expansion of memory

◆ Disk Storage Capacity

Purchase of additional disk storage capacity is inexpensive, costing about \$6000 for a 670 megabyte disk drive. Purchase of this capacity is recommended for FY94.

◆ Computer Ports and Data Terminal Interfaces

To eliminate the growing number of users who are unable to access to the HP3000 during peak operations, twelve data terminal interfaces would need to be added to the ROLM switch and 12 HP3000 ports would need to be added to the HP3000 in the next year at a cost of approximately \$10,000. As a cost reduction measure, increased emphasis is being placed on communicating by HPDesk rather than by memorandum. This should result in significant printing cost savings, but it will result in an increased number of users accessing HPDesk on a regular basis. In addition, a number of new applications are under development which will use the mainframe to replace routine clerical functions such as the generation of contracts and on-line budgeting. Therefore, even if the number of employees remains constant, the demand for access to the system is expected to increase, and additional ports will be necessary to provide adequate service to users.

Assuming that the LAN installation remains on schedule, the purchase of the ports should be delayed until it is determined how many users will access the HP3000 through the LAN. If all users have only LAN access, expansion of the ports would be unnecessary. The move towards a distributed processing environment should also reduce the need for additional ports.

◆ Memory

The system utilization test indicated that during peak periods, the memory management disk IO rate reached well beyond the recommended maximum, indicating a need to expand memory. Because peak periods occur during registration, memory may need to be increased if the registration process is to be maintained in way that provides efficient and effective service to students. The cost to add 16 megabytes of memory is approximately \$18,000. It is anticipated that this will need to be purchased in FY94, but the decision should depend on observed response times during peak periods. If response times continue to be acceptable, the purchase should not be made because memory expansion might be part of a future CPU upgrade or replacement. The impact of the LAN on the system should also be monitored closely.

◆ Touchtone Registration System

The Touchtone Registration system will allow students to register for classes by telephone. This system has been purchased and is scheduled for implementation by intersession in January of 1994.

Room Scheduling System

The current system of manually scheduling rooms for classes and community use is virtually impossible to manage effectively. We have purchased room scheduling software, Schedule 25 and Schedule 25 E, from Universal Algorithms Corporation at a one-time cost of approximately \$42,000. Expected implementation date is spring of 1994.

Student Tracking System

A Student tracking system provides a method to track the progress of cohorts of students as they proceed through their academic programs. Staff can use this information to identify at-risk students, plan for retention, and modify academic programs. The development of a tracking system involves the extraction of data from the student database and the formatting of the data into user-friendly reports without the necessity of writing a new program for each inquiry. This software has been written by in-house programming staff, and data from the first cohort of students is expected by January, 1994.

Long-term administrative Hardware and Software Investments

◆ HP 3000

The HP3000 is currently performing satisfactorily in terms of CPU utilization. With the addition of memory and expanded disk capacity, it should meet the needs of the college for the next three to five years. However, Hewlett Packard estimates that the life span of the HP3000 Series 955 is about 5 years. After that period, newer technology is expected to obsolete the old equipment. Although support for the old equipment continues for few more years, the maintenance costs begin increasing dramatically, and it typically becomes more cost effective to purchase the newer technology. In addition, if the college moves in the direction of a college-wide network with a high volume of users accessing information or peripherals through the mainframe, the existing CPU could quickly become inadequate. There is some evidence of this already after one small LAN has come on-line.

Therefore, it is recommended that in FY94, the college begin to prepare for replacing or upgrading the HP3000 Series 955. These questions should be answered as part of the analysis:

1. What platforms and hardware vendors support the CEI software? It is not feasible to change a student database more than once every ten years because of the massive record conversion and user training requirements.
2. If CEI can run on other equipment, are there price/performance benefits to changing vendors considering training, conversion, hardware, and software costs?
3. Assuming the consideration of other vendors is feasible, what is the disposal value of the existing HP3000?
4. Which vendor and which equipment best prepares the college for compatibility with current and future technological innovations and provides the most open operating environment?
5. What effect will the move to a distributed processing environment have on the HP3000 and is this a viable and cost effective alternative?
6. Which vendor's equipment provides the best support to the instructional computing program?

If Hewlett Packard were to be the vendor of choice, it is estimated that an upgrade to the next level, the HP3000 Series 960, would be approximately \$100,000, however this upgrade may not be adequate depending on requirements at that time, and pricing structures may change. Hewlett Packard upgrades normally use new versions of the same software so both software and training costs and time are minimal. Choices of equipment will be limited to platforms supported by the CEI software, but consideration should be given to a UNIX platform if this is feasible.

◆ INTERNET Communications Equipment

There is increasing interest in the capability to communicate with other colleges and universities through a higher education and research communication network called INTERNET. In addition to providing the capacity to share information with colleagues, INTERNET provides access to grant information, to numerous databases containing information related to higher education such as available software, to library databases and the capability to instantly fax journal articles and other materials to the user, and to a network that will provide the capability to receive and transmit transcripts electronically.

The college has accessed INTERNET through a node at the University of Maryland at a very small cost. Users currently have access to the mail portion of INTERNET through HPDesk but cannot access the multitude of available databases until a local area network is installed. A limited number of students and faculty will begin experimenting this year through one terminal installed in the library.

◆ Other Mainframe Software

The college began migrating all users towards a Windows environment during FY93. Only Windows-based software will be supported in the future. Extensive staff training is in progress. It is expected that there will be advantages to continuing migration to the 32 bit version of Windows when it is released next year at an estimated upgrade cost of \$50 per user with unknown memory requirements. It is recommended that the college budget for this upgrade in FY95 and FY96.

Two additional CEI modules should be scheduled for purchase within the next year. The Admissions Module provides for the tracking of each student application to the college from inquiry through admission and registration. This will provide information to ensure that all groups have access to college programs and will assist staff in eliminating barriers that prevent students from matriculating. The cost of this module is \$15,000 and is recommended for purchase in FY94.

The on-line Purchasing Module, the first CEI module which will run on a file server rather than the HP3000, provides for desktop entry and approval of purchase requisitions and the automatic generation of a purchase order without re-keying data. Both modules will provide for better control of the institution's resources and will provide expanded services without the addition of personnel. This module should be purchased as soon as it is released (estimate is first quarter of 1994) and should be implemented during FY94.

It is expected that by late FY94 or early FY95, CEI modules using a graphical user interface and based on a relational database and a Uniface front end will be available. Cost to purchase these is expected to be around \$20,000 for a runtime license for Uniface. A significant investment in end user training may also be necessary. Early demonstrations of this product indicate that there will be enormous advantages to moving to this environment, and it is recommended that the necessary purchases be made at the earliest possible time.

Investment in Instructional Hardware and Software

The use of technology as an integral part of the instructional process has expanded rapidly over the last few years and will continue to expand even more rapidly in the future. Not only will computers and software be necessary to maximize learning, interactive video will provide even greater capability to individualize instruction to meet the needs of learners. To support this technology, high speed processors, large disk storage capacity, and high resolution graphics capabilities will be necessary on all computers. A common graphical interface will be necessary to assure that both students and faculty can more easily use the increasing number of software packages that routinely will be part of the instructional process.

Based on the analysis of future computing needs of academic programs (See page 8), necessary hardware and software investments over the next five years are as follows:

	YEAR 1		YEAR 2		YEAR 3		YEAR 4	
	No.	Cost	No.	Cost	No.	Cost	No.	Cost
Computers	120	\$180,000	140	\$210,000	63	\$97,500	65	\$97,500
Interactive Video	30	\$90,000	30	\$90,000	30	\$90,000	30	\$90,000
Software & Upgrades		\$100,000		\$150,000		\$100,000		\$100,000
TOTAL		\$370,000		\$450,000		\$287,500		\$287,500

The cost for computers is based on a MS-DOS 486-33 clone with a 130 megabyte hard disk, high resolution VGA color monitor and adapter, and 4 megabytes of RAM. This is the minimum processor that will support full motion interactive video and most graphics intensive software. As technology changes and prices drop, the costs could be less, or faster processors, such as the 486 50 mhz machine with larger hard drives and CD-ROM drives, might become the machine of choice. Based on expected increases in the need for speed, memory, and storage, each microcomputer purchase should be carefully evaluated to ensure that specifications meet the requirements of current and future applications. The 390 units needed over five years include replacing all non-386 computers in instructional labs with 486 machines and purchasing all the new machines needed to provide for projected expansions in use in all student labs. Software costs include an expected need to upgrade to new versions of Windows.

The cost for interactive video equipment includes the cost for Level III Interactive video disk players, system software, and audio and full motion video cards for each unit.

Software costs include Windows and WordPerfect for all units, specialized instructional software base on the use of the equipment including the expansion of site licenses, and various specialized video disks.

Networking in instructional labs will also be necessary because software maintenance becomes almost unmanageable when the number of individual computers reaches 500. However, successful networking in an instructional lab requires the availability of a network technician because of the increasing complexity of lab use for faculty and students. These labs will be networked as part of the college-wide network design.

Increases in personnel costs will be necessary to support the increased numbers of classrooms and laboratories. In the FY94 budget, the Lab Supervisor position was upgraded to the assistant instructor level and a half-time evening/weekend supervisor position was budgeted. Although increased costs for laboratory assistants and supplies and repair parts should be covered by increased student fees for specific courses, repair technicians and additional supervisory personnel will need to be provided from the college budget. This need will escalate as a significant number of student labs move to Hickory Ridge in the fall of 1995, making support from current personnel more difficult. New positions are recommended as follows:

FY94 No additional personnel (except those already hired)

FY95 Lab/Network Technician (\$22,000 plus benefits)

FY97 Evening/Weekend Laboratory Coordinator (\$27,000 plus benefits)

Other instructional computing equipment and software considerations for the next two to four years include:

1. Capability for the development of multimedia-based instructional materials should be provided to faculty. Equipment has been purchased for this initiative, but it has been only marginally successful because of lack of support for faculty as they learn to use this complex software. It is recommended that in FY95, the current graphic artist/computer specialist position be upgraded to become an instructional technology development consultant, and new graphic artist position be added. The net cost of this is \$30,000 plus benefits for the new position.
2. Additional capability to display multimedia presentations in the classroom will need to be added each year. There are several solutions costing from \$1,000 to \$10,000 per classroom, depending on the quality needed. It is recommended that \$20,000 be budgeted each year to provide classroom projection capability.
3. Science laboratories need the capability to project images from microscopes onto large screens and to capture these images for inclusion in multimedia instructor-developed software. In addition each lab needs computers and video disk equipment for student use in conducting experiments. It is recommended that \$40,000 be budgeted per year for scientific computing equipment.
4. Funds need to be budgeted to maintain current releases of all software in all labs. Estimated cost per year is \$20,000 to \$40,000 per year.

Investment in Upgraded Hardware and Software for Staff

All staff members, except those who do not work at a desk, now have computers. Although a few still have XT's or 286's, everyone that wants a 386 or 486 has one. As technology changes and prices drop, faster processors, such as the 486 50 Mhz machine, might become the machine of choice. Based on expected increases in the need for speed, memory, and storage, each microcomputer purchase should be carefully evaluated to ensure that specifications meet the requirements of current and future applications.

To replace all existing XT and 286 type machines and to provide for expected increases in faculty and staff, approximately 100 new computers will need to be purchased over the next five years. In addition, the 50 existing 386 machines will need to be replaced within a couple of years and some power-users will no longer find the 486/33 platform adequate so it is estimated that at least half of our 125 486's will need replacing. Hardware and software investments are planned as follows:

	YEAR 1		YEAR 2		YEAR 3		YEAR 4	
	No.	Cost	No.	Cost	No.	Cost	No.	Cost
Computers	30	\$45,000	60	\$90,000	70	\$105,000	50	\$75,000
Upgrades		\$30,000		\$20,000		\$20,000		\$20,000
Software		\$20,000		\$40,000		\$40,000		\$20,000
TOTAL		\$95,000		\$150,000		\$165,000		\$115,000

Software costs include Windows 3.1 and WordPerfect for Windows for all machines, and expansions of site licenses for Quattro Pro and Paradox on machines as needed by individual users. As existing 386 and 486 machines are replaced, these machines can be given or sold to faculty and staff for home use, unless still adequate for student labs. In addition, it is recommended that five 486 VGA notebook computers be purchased beginning in FY94 so that staff can check out the laptops to take home for projects that cannot be completed on older equipment. The estimated cost per unit is \$3,000. Software amounts also include expected upgrades to Windows.

Archival of Records on an Optical Disk

The college currently spends an average of \$10,000 per year microfilming critical records, primarily in the student records and accounting areas. In addition, huge numbers of hard copy records are kept in various college offices and storage areas. Access to records both on microfiche and in hard copy format is cumbersome and time consuming.

A solution to the problem of records storage would be the purchase of optical scanning equipment. The premise behind optical disk archiving is that records are stored in computer form so they are protected from age deterioration, can be stored in much less space, can be put into a database for sorting and searching, and can be retrieved by users on a network and transferred back into hard copy when needed.

It is proposed that we purchase the HP9000 UNIX server as a solution for records archiving and for teaching UNIX in the instructional program. The Hewlett Packard document scanning and management product called AIMS (Advanced Image Management System) which uses the HP9000 as a document server is recommended. The cost for the HP9000, and high speed, multipage scanner, software, and dedicated optical disk is \$60,000. Other vendors have comparably priced systems, but this HP solution has the advantage of providing desktop retrieval to users on a future college-wide network using a familiar user interface.

Additional personnel costs would be incurred to provide for scanning of records. It is estimated that this could be accomplished with an hourly person working fifteen hours per week at a total yearly cost of \$7500.

This investment would pay for itself in savings in microfilming costs in about 6 years, but more importantly, it would provide much more effective and efficient storage and retrieval of documents.

It is recommended that this proposal be reevaluated in 1995 and considered for purchase in 1996.

Fiber Optic Network

All of the college's current connectivity is accomplished via the college's ROLM telephone system which gives faculty and staff with microcomputers access to the HP3000 host at data speeds of 19.2 kilobits per second. However, there are many applications available today which require higher speeds to make it possible to transmit larger amounts of data in less time than would be possible with the 19.2 kilobit limit. Examples of these applications include computer-generated graphics, computer-aided design, document management, imaging, and full-motion video. It is expected that within the next three years C & P telephone will install fiber optic cabling to the college, opening up vast opportunities to receive full-motion video transmissions from other colleges, from art museums, science laboratories, training sources etc. It promises to change the nature of educational delivery.

Although it would be fairly inexpensive to equip one area to receive these transmissions, the real value will be when every classroom, faculty office, and student work station has the capability to receive these transmissions. In addition, as changes in our knowledge of learning theory lead instructors to continually expand the use of visual materials and multimedia applications in the instructional process, the demand to provide more video service to every classroom is increasing rapidly. This is quickly making the old system of delivering specific equipment and materials to specific classrooms unfeasible.

Administrative applications will also require high speed data transmission in the future. The capability to access high speed laser printers, to store and retrieve documents on an optical disk, to share graphics intensive data, and to manage the distribution and installation of microcomputer software are needs that exist today. Others will undoubtedly develop as technology expands.

A fiber optic network will also provide the capability for improved faculty access to student records using a graphical interface to access transcripts and advising plans. Some programming will be necessary to provide the graphical interface which may require some contract programming. Students will also be able to use the computers available in student labs and in public access to access their own records.

During FY93, the college has completed the design for a college-wide fiber optic local area network. The network plan envisions a collapsed backbone configuration with fiber from a central router to workgroup sub-LANs which would use 10 megabit Ethernet twisted pair cabling. The total cost of the network is expected to be \$450,000 including partial implementation of the classroom audio visual/multimedia system. Funds are available from renovation funds for over \$400,000 of this project in FY94. An additional \$50,000 should be budgeted in FY95. The contract for facilities management of the Information Services Department includes providing personnel for managing the bidding, installation, implementation and management of the LAN. Detailed plans for the network design can be found in the Network Design document.

In anticipation of the fiber optic network, the administrative wing and the business office and computer services area will be networked in FY94 at a cost of \$40,000.

Classroom AudioVisual/Multimedia System

A campus-wide fiber optic network and other advances in technology provide the capability to electronically link classrooms with a centralized audio/video distribution system that eliminates the need to carry equipment over campus and provides faculty with the opportunity to use multiple types of video materials and equipment in one lecture. Using a simple remote control, faculty can access audio, film, video disk, text and images from an audiovisual center. Faculty can also develop their own lecture materials, including both images, full-motion video and text, and can easily access the materials from the lectern with the same remote control.

Costs to equip 10 classrooms are included in the preliminary Network Design Plan. Assuming that this proves to be successful and cost effective, funds should be budgeted to equip an additional 10 classrooms each year at a cost of about \$100,000 per year beginning in FY96.

Training

The gains from significant investments in technology will not be maximized if staff training is not part of the plan. To function effectively in the HCC environment of the 30's, most staff will need to have a high computer skill level. Each job should be evaluated to determine the computer skills necessary to function effectively and efficiently in that job. A training plan should be developed for all staff members to bring them up to the required skill levels. Although it is difficult to estimate the cost of training before a detailed analysis of needs is completed, a rough estimate would be that each staff member needs an average of 20 hours per year in software training. It is not feasible for existing college staff to perform this training needs analysis so it is desirable to budget \$10,000 in FY95 to hire a consultant to develop comprehensive skill sets and methods of demonstrating competency for various job levels.

The college has hired a combination Help Desk/Trainer who will spend half of each day in training activities, either classroom or one-on-one. However, by FY96 this position will need to be split into a full-time Help Desk Coordinator and full-time trainer at an estimated cost of \$30,000 per year plus benefits.

In addition to general staff training, funds will need to be budgeted to continually upgrade the skills of the computer staff. Although training for employees who become part of the facilities management contract will be the responsibility of the contractor, at least \$1000 per person per year should be allocated for the remaining telecommunications staff.

Disaster Recovery

The FY92 college audit recommended that specific disaster recovery procedures be developed for the Information Services area. Although there are expensive alternatives such as contracting with Hewlett Packard or another third party vendor for these services, the college has entered into a reciprocal agreement with Ryland Corporation that allows for the sharing of emergency computer services at no cost to either organization. The college should continue to explore the feasibility of a hot-site since that may now be a more viable alternative because of the new relationship with MagNet services which has hot site capability.

Information Kiosks

Students should have access to their own transcripts, advising information, financial aid information and other appropriate information through student stations in labs and through information kiosks located in public areas. These same kiosks could be used to provide directions and information for visitors to campus. It is expected that some new screens will need to be designed and perhaps some multimedia materials developed. A team should be formed in FY96 to develop the design for the project with implementation scheduled for FY97. It is difficult to estimate cost because it greatly dependent on the technology used, but at least \$10,000 should be budgeted for each of ten kiosks plus \$50,000 for programming and multimedia design.

Appendix A - Strategic Goals and Priorities

◆ Student Learning And Teaching Excellence

- Goal A:** Students will achieve their stated learning objectives.
- Goal B:** Students will express satisfaction with the quality of their educational experience.
- Goal C:** Evidence of student learning will be demonstrated, including measures of value-added education.
- Goal D:** The academic staff will be involved in teaching improvement activities designed to improve student learning.
- Goal E:** The college will provide an intellectual environment which promotes student learning.

◆ Student Access

- Goal A:** Educational opportunities at HCC will be made available to every member of the community.
- Goal B:** Developmental services will be provided to allow students to participate in college courses.
- Goal C:** An image of openness and excellence reflective of the college will be maintained in the community.
- Goal D:** An efficient and effective admissions and registration process will be emphasized.
- Goal E:** Physical and facilities barriers to educational opportunities should be reduced and/or eliminated.
- Goal F:** Financial barriers to education should be reduced through management of both tuition rates and financial aid.

◆ Customer Service

- Goal A:** The college will provide excellent service to its students.
- Goal B:** The college will maintain an effective environment for its employees.
- Goal C:** The college will maintain a positive image in the community at large.

◆ Valuing Diversity

- Goal A:** The college will meet its commitment to recruit, hire and retain individuals from under-represented groups.
- Goal B:** The college will promote cultural diversity and understanding within the institution.

◆ Management Excellence

- Goal A:** The college will fulfil its mission and purpose as reflected in its statement of strategic priorities.
- Goal B:** The college will achieve effective outcomes in each of the four management process groups - planning, organizing, leading and controlling.